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(54) Title of the invention: Optical disk

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## **Details**

### **1. Title of the invention**

Optical disk

### **Scope of Claim**

Optical disk obtained by forming a recording film on a substrate having a tracking groove on it. A transparent plate is provided on the opposite (with respect to the recording film) side of the substrate or surrounding both the substrate and the recording film. Light is allowed to incident from the opposite (with respect to the recording film) of the substrate to replay (reproduce) the recording. Further, the above substrate consists of any of the following: polyimide resin, polyphenylene oxide resin, polyether sulphone resin, polyphenylene sulfide resin, polyallylate resin, polysulfon resin, polyether etherketone resin, thermally fused fluorine resin and polyoxybenzoyl resin.

### **3. Detailed description of the invention**

This invention is concerned with an optical disk used for recording and reproducing information by making use of a laser.

### **Conventional techniques**

Recently, along with the enormous increase in the quantity of information to be processed by information processing system, a medium (especially optical disk) that can record large amount of information has attracted attention in the fields like image information processing and office automation. Recording is done by irradiating the recording-film by light beam, thereby causing local temperature rise or chemical change.

Conventional optical disks have structure such as the one shown in Fig. 3. Thus on a transparent substrate 31 made from plastic or glass and having a tracking groove, a base layer 32 is prepared for preventing damage of the substrate due to heat or for improving recording properties. A ferromagnetic film of rare earth-transition metal recording film or tellurium compound film or thermoplastic resin film 33 is created and for protection, a substrate 34 is pasted by means of an adhesive 35.

For avoiding deterioration of the reproduction properties due to soiling of the surface of the optical disc due to dust, the reproduction is carried out by irradiating the recording film with an optical beam like laser beam, from transparent substrate-side with tracking groove. While doing this, the optical beam diameter is made sufficiently large at the light-incident side of the substrate and for avoiding the effect due to soiling; the thickness of the transparent substrate is set around 1mm.

Further, the base layer and the layer on which the recording surface is created are pasted by means of an adhesive on the transparent substrate so that the recording film face each other and sometimes it is used for recording on both sides.

#### **The problems this invention sought to solve**

In case of the optical disk with the structure mentioned above, tracking groove is made on the transparent substrate on which light is allowed to fall and this transparent substrate is required to have excellent optical properties, moisture resistance, thermal resistance and it should be easy for making groove on it. Further, for mass producing optical disk and lowering down the cost and improving the productivity, it is necessary to reduce the time required for making film on the substrate. The time of making a film on the substrate gets restricted due to its thermal resistance. When the conventional resin with thermal resistance temperature below 120°C is used, the productivity gets limited to a certain level. The acrylic acid resin used for conventional optical disk substrate having a groove is very good in optical properties and groove formation, but not good as far as thermal resistance is considered. The polycarbonate resin has good thermal resistance and it is not good for groove making and productivity, but its optical properties like double refraction are inferior. In case of epoxy resin or glass, the optical properties and thermal resistance are good but they are not good as far as groove formation and productivity are considered.

After considering these problems, this invention presents optical disk with excellent optical properties, thermal resistance, moisture resistance, groove making properties and productivity.

### **Procedure for solving the problems**

For solving the above problems, the present invention has provided a grooved track for forming recording film and a separate transparent substrate for allowing the light to fall upon it, thus dividing the respective functions. The substrate consists of any of the resins like polyimide resin, polyphenylene oxide resin, polyether sulphone resin, polyphenylene sulfide resin, polyalilate resin, polyether ether ketone resin, fused fluorine-base resin or polyoxybenzoyl resin that can form a grooved substrate having thermal resistance of at least 150°C.

### **Working**

In this way, any of the resins like polyimide resin, polyphenylene oxide resin, polyether sulphone resin, polyphenylene sulfide resin, polyalilate resin, polyether ether ketone resin, fused fluoro resin or polyoxybenzoyl resin (that have excellent thermal resistance and relatively easy to mold) is used for grooved track for forming the recording film. A material showing excellent optical properties like low double refraction and moisture resistance (such as epoxy resin, silicone resin or glass) is used for transparent plate for introducing light, thereby distributing the functions. This has realized mass production of optical disk with high quality.

### **Application examples**

This invention is explained with reference to the Figures. Fig. 1 shows the structure of optical disk of this invention. In Fig. 1, 11 is a grooved substrate made from polysulphone resin for making recording film. 12 is the base layer SiO film and serves as protection layer and 13 is

recording film of rare earth-ferromagnetic transition metals like TbFe, GdTbFe or TbFeCo.

14 is a transparent sheet for receiving the light.

For forming a recording on the grooved sheet of epoxy resin 11 film, SiO film 12 (30 ~ 200 nm), rare earth-transition metal ferromagnetic film 13 (100 nm) and SiO film 12 (30 ~ 200 nm) are made by thermal deposition or sputtering and, a transparent epoxy resin is coated and fixed in the form of a sheet, so that the thickness on the incident light side is 1 ~ 1.2 mm.

The optical disk in Fig. 1 showing optical disk of this application example is a thermoplastic polysulfon resin having high thermal resistance and therefore, high-speed formation of grooved substrate is possible without causing any damage by sputtering method and it is excellent for mass production. At the same time, since the distance between the target and substrate can be reduced, the yield from the material during the formation of film is improved. On the other hand, because the double refraction on the light-projecting side is less and since a moisture resistant epoxy resin is used, the quality and reliability of signal is excellent.

In this way, the productivity is improved 1.6 times of the conventional one, and the yield of material during formation of film is improved 50% and thus the cost can be greatly reduced.

In the application example of this invention, polysulphone resin is used for grooved substrate for recording film formation, the base layer and protective skin layer is prepared from SiO film, the recording film is made from ferromagnetic rare earth-transition metal and transparent sheet for receiving light is made from epoxy resin. However, the grooved substrate for

recording film formation can be made from any of the following resins: polyimide resin, polyphenylene oxide resin, polyether sulphone resin, polyphenylene sulfide resin, polyalilate resin, polyether ether ketone resin, fused fluorine-base resin or polyoxybenzoyl resin, the lower layer and protective layer can be made from various nitride films or oxide films, the recording films can be made from tellurium alloy or thermoplastic resin. The thickness of the light-incidence side of the transparent sheet for receiving the light is in the range of 0.8 ~ 1.6 mm and it can be made from silicone resin, polyester resin or glass. When glass is used as transparent sheet for receiving light, glass is pasted by means of an epoxy resin so as to sandwich and cover the recording film as well as grooved substrate on both sides or it is sealed hermetically.

It is also possible to make an optical disk with both of its sides capable of recording and reproduction, as shown in Fig. 2.

#### **Effect of the invention**

By providing grooved substrate for recording film formation and transparent sheet for receiving the light by distributing the functions separately, and by using highly thermally resistant thermoplastic resin for the grooved substrate, mass production of an optical disk with excellent quality has become possible.

#### **4. Simple description of the Figures**

Fig. 1 shows cross section of the optical disk from application example of this invention.

Fig. 2 is the cross section of the optical disk from another application example of this invention.

Fig. 3 is cross section of conventional optical disk.

11: Grooved substrate for recording film, 12: SiO film, 13: ferromagnetic rare earth-transition metal film, 14: Epoxy resin film for receiving light. 21: Grooved sheet, 22: Lower layer and protective layer, 23: Recording film, 24: Transparent sheet for receiving light.

Fig. 1, Fig. 2 and Fig. 3 (the matter accompanying the arrow mark in the figures): Laser beam

